Taking the Climate Forecast System to the Next Level

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April 30, 2012
College Park, MD

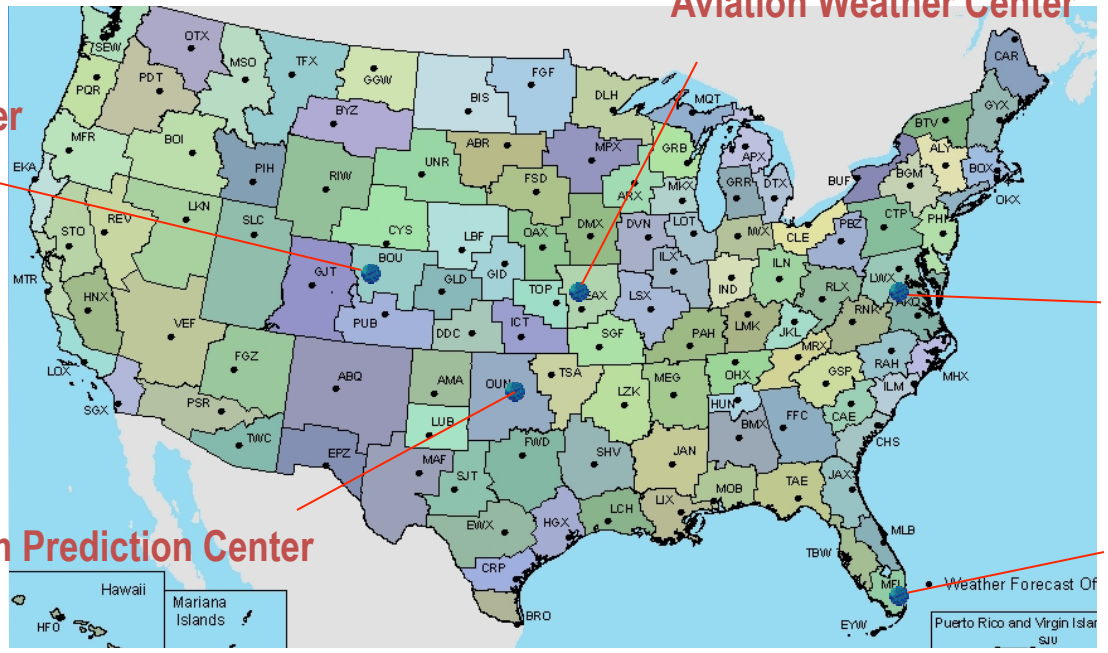
Outline

- NCEP overview
- Use of CFS Version 2.0 Within Seamless Suite of Products
- Test Beds and the R2O Challenges
- NCEP Vision for CFSv3
- NCEP Commitment for CFSv3
- Expectations for this meeting

NCEP Supports the NOAA Seamless Suite of Climate, Weather, and Ocean Products

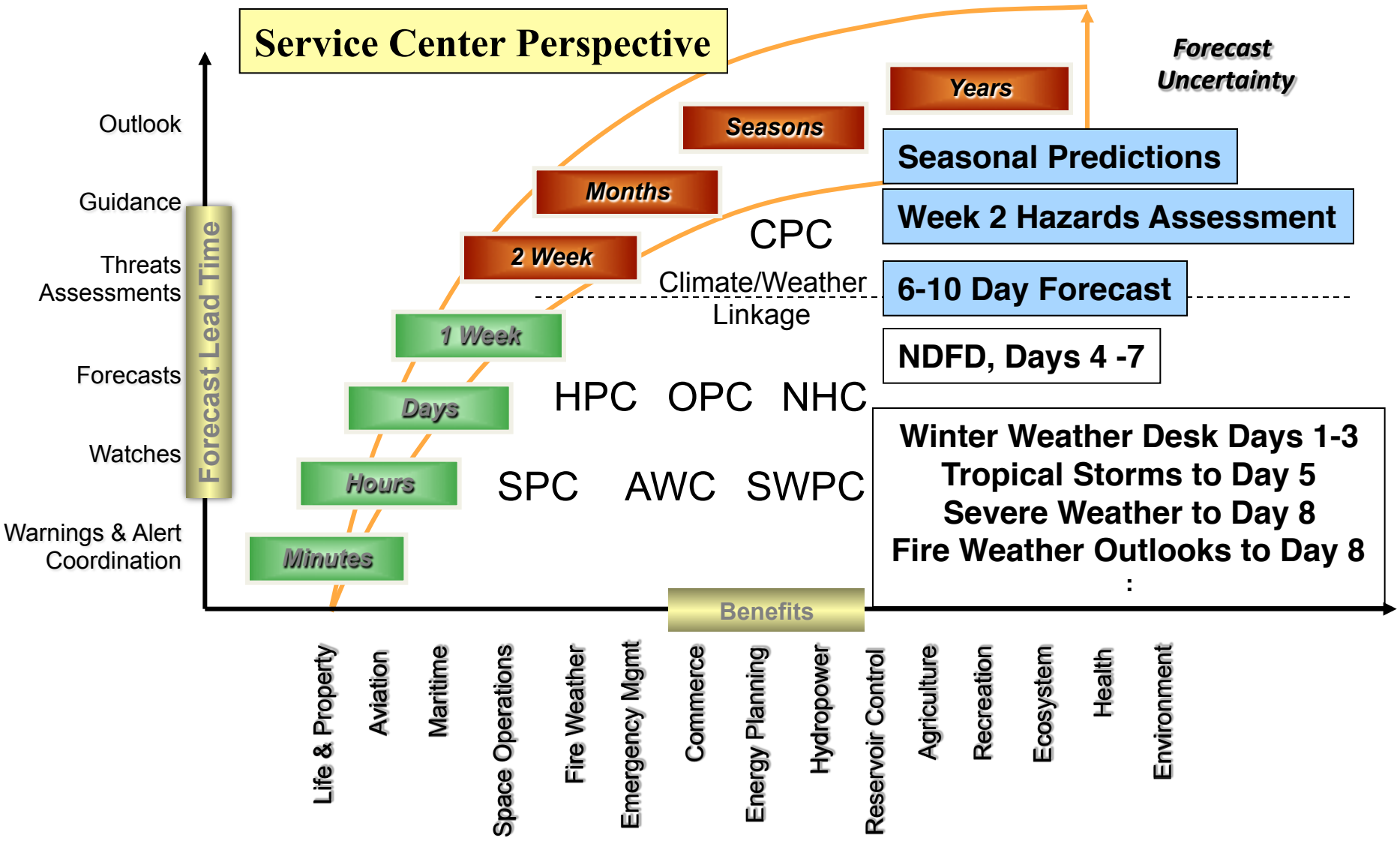
Organization: Central component of NOAA National Weather Service

Mission: NCEP delivers science-based environmental predictions to the nation and the global community. We collaborate with partners and customers to produce reliable, timely, and accurate analyses, guidance, forecasts, and warnings for the protection of life and property and the enhancement of the national economy.



Vision: The Nation's trusted source, first alert, and preferred partner for environmental prediction services

NOAA Seamless Suite of Forecast Products Spanning Climate and Weather



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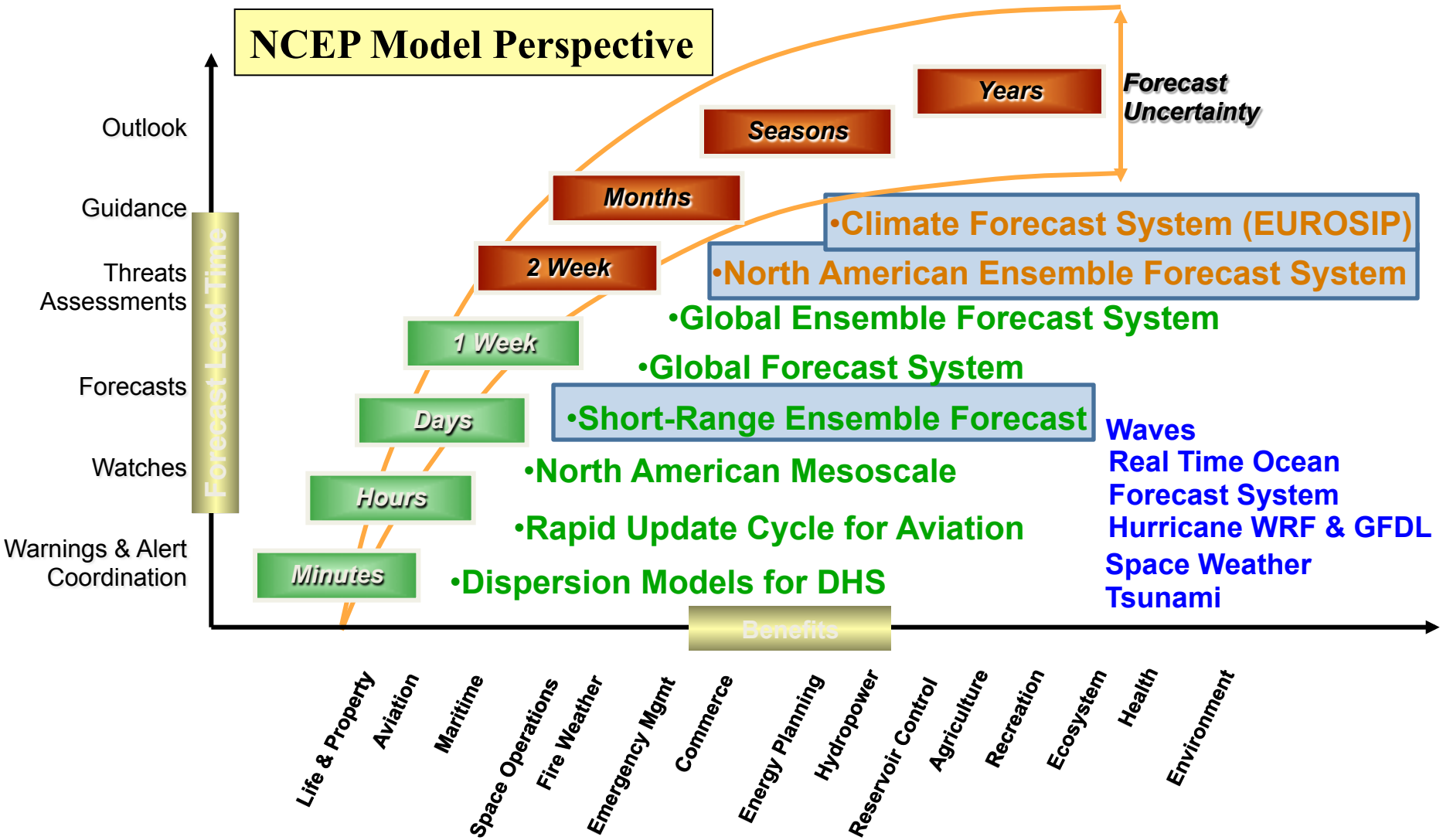


NOAA Climate Forecast System (CFS)

Attribute	CFS v1.0 Operational Since 2004	CFS v2.0 Operational Since March 2011
Analysis Resolution	200 km	27 km
Atmosphere model	2003: 200 km/64 levels Humidity based clouds	2010: 100 km/64 levels Variable CO2 AER SW & LW radiation Prognostic clouds & liquid water Retuned mountain blocking Convective gravity wave drag
Ocean model	MOM-3: 60N-65S 1/3 x 1 deg. Assim depth 750 m	MOM-4 fully global ¼ x ½ deg. Assim depth 4737 m
Land surface model (LSM) and assimilation	2-level OSU LSM No separate land data assim	4 level Noah model GLDAS driven by obs precip
Sea ice	Climatology	Daily analysis and 3-layer interactive sea ice model
Coupling	Daily	30 minutes
Data assimilation	Retrieved soundings, 1995 analysis, uncoupled background	Radiances assimilated, 2008 GSI, coupled background
Reforecasts	15/month seasonal output	24/month (seasonal) 124/month (week 3-6)

Distribution of CFS Version 2.0

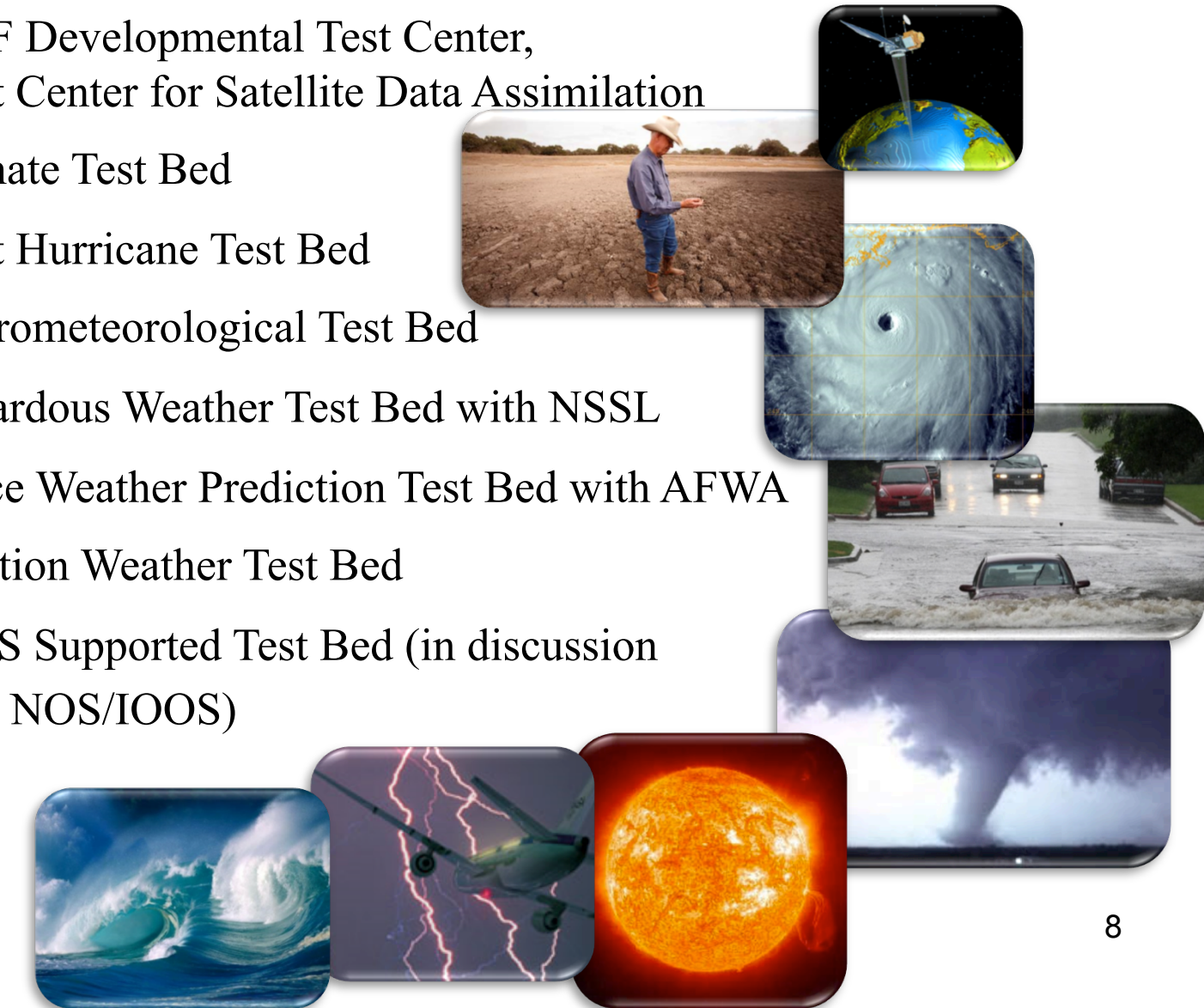
- **Code**
  - COLA – used as a research model for decadal to 100 year + experiments
  - India – used by IITM for research and R2O (IMD) focused on monsoon prediction/evolution

- **Model Data**
  - CFSv2 Reanalysis and Reforecast (CFSRR) distributed globally via NCDC/NOMADS used by many countries
  - CDAS (real time CFSv2 Reanalysis) and real time CFSv2 forecast (7-day rotating) archived at NCEP
  - Combined within an IMME (EUROSIP) and a NMME (experimental; NCAR, GFDL, GSFC)

Test Beds and the R2O Challenges

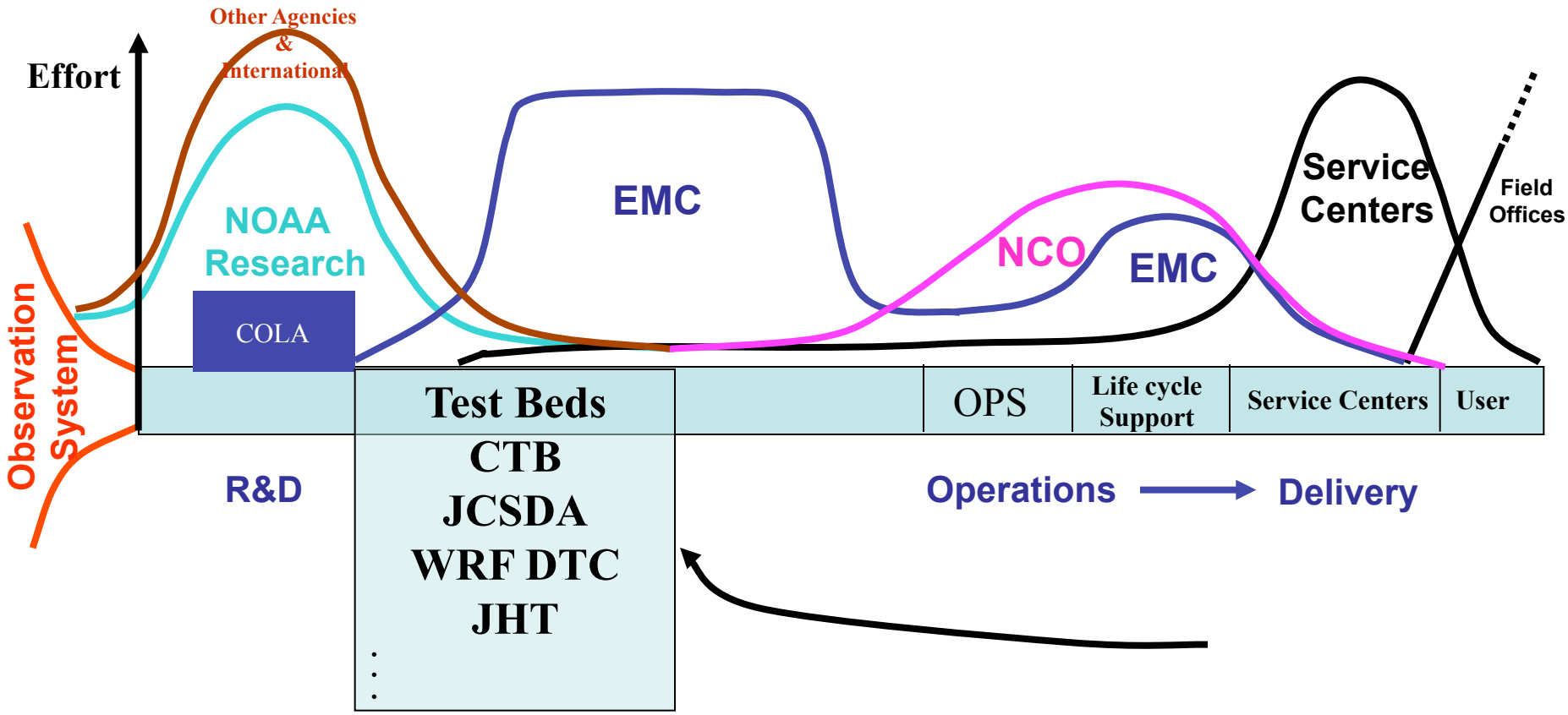
Service – Science Linkage with the Outside Community: Accelerating the R2O Transition Process

- EMC — WRF Developmental Test Center, Joint Center for Satellite Data Assimilation
- CPC — Climate Test Bed
- NHC — Joint Hurricane Test Bed
- HPC — Hydrometeorological Test Bed
- SPC — Hazardous Weather Test Bed with NSSL
- SWPC — Space Weather Prediction Test Bed with AFWA
- AWC — Aviation Weather Test Bed
- OPC — IOOS Supported Test Bed (in discussion with NOS/IOOS)



Schematics in the Model Transition Process

EMC and NCO have critical roles in the transition from NOAA R&D to operations



Operations to Research

Transition from Research to Operations

Launch List – Model Implementation Process

Concept of Operations

Requirements

Criteria

Forecast benefits, Efficiency, IT Compatibility, Sustainability

UCAR Review Recommendations for NCEP/EMC from the UCAR Review: Enhancing community engagement for the CFS

1) Create a culture and work environment that attracts an extraordinary cadre of talented scientists

2) Increase computer capacity for R2O process ….

3) Provide adequate human resources …

4) Employ data assimilation capabilities that are significantly advanced ..

5) Embrace an entirely new approach to model development and implementation. "It should be an effort that involves the entire national weather modeling community and engages partners from other agencies, academia, and the private sector"

- NCEP is working on all items above
- Important steps being taken to streamline the implementation process in accordance with this recommendation

My goal is to make these recommendations work for the use of CFS version 2.0 and development of CFS version 3.0

NCEP Past and Ongoing Collaborations With the External Community

- **Ensemble-based hybrid data assimilation system** jointly developed by NCEP, NASA, NOAA-Lab, and U. of Okahoma will be implemented in NCEP operation in May, 2012.

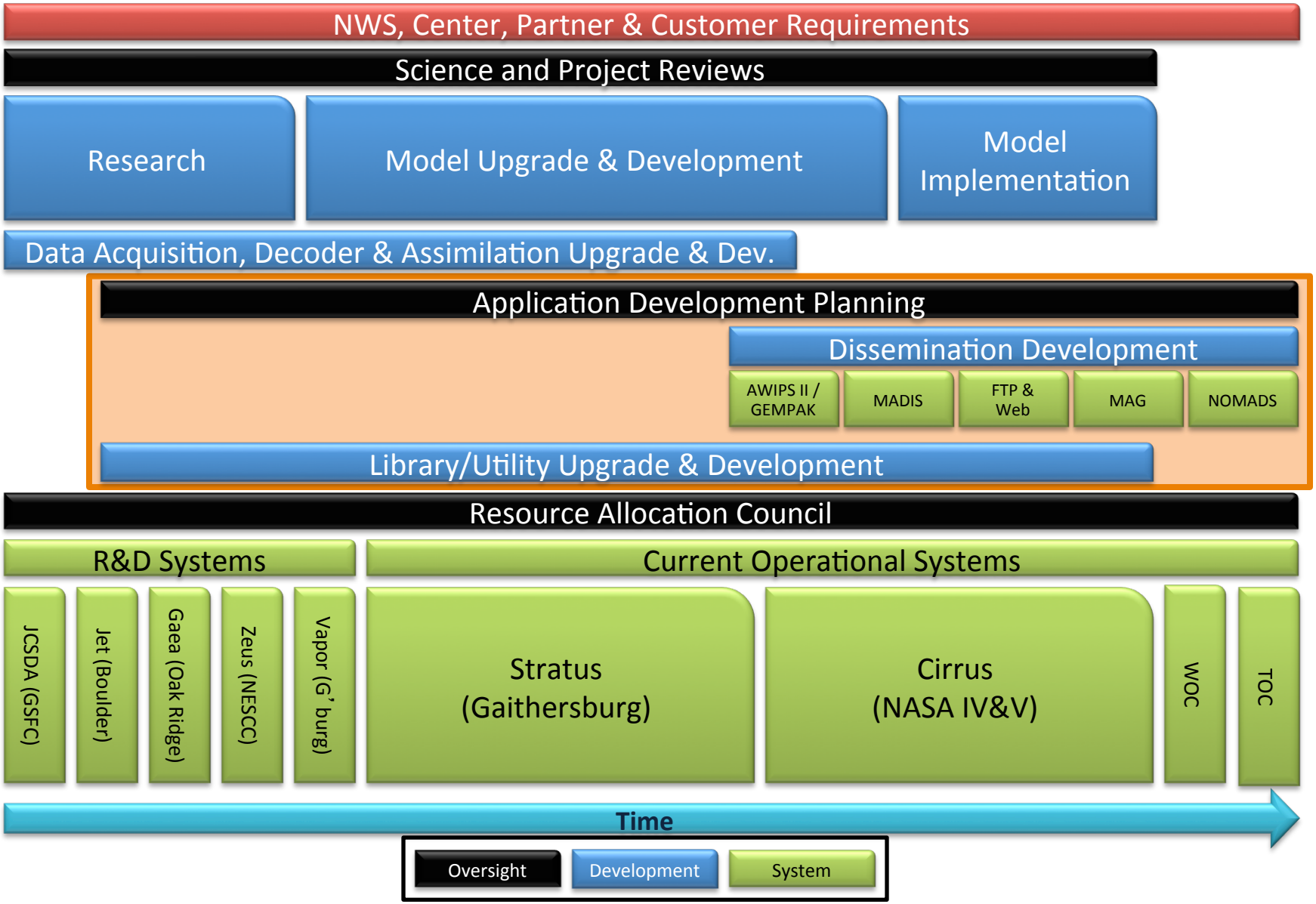
- EMC and Developmental Testbed Center (DTC) at NCAR are transitioning advances in **meso-scale modeling** into NCEP operations.

- NCEP and Canadian Meteorological Center (CMC) jointly developed the **North American Ensemble Forecast System(NAEFS)** for weather forecasts

- NCEP CFS is included in the **EuroSIP** multi-model ensemble for monthly and seasonal forecast

- Climate Test Bed (CTB), EMC, CPC and the community are developing the US National Multi-model ensemble (**NMME**) for ISI forecasts.

NCEP End-To-End Development Process



NCEP Vision for CFSv3

- **Embrace a unified weather-climate modeling strategy**
  - Currently CFS is the dynamical model (coupling GFS with ocean and sea ice models) for **operational Intraseasonal, seasonal to Interannual (ISI) prediction**
  - A **unified weather-climate model requires model upgrades to meet both weather and climate requirements**

- **Develop and sustain the CFS as the operational climate forecast system for the nation by combining forces from the research community including other NOAA labs/centers**

Expectations for this Workshop

- **Assess CFSv2**
  - Document CFSv2 improvements over CFSv1
  - Identify key model biases in CFSv2

- **Develop the vision and strategy for CFSv3**
  - Agree on the vision for CFSv3
  - Determine the CFSv3 Structure: a continuation of CFSv2 or "bold and far-reaching"
  - Identify mechanisms and areas/components to incorporate new model development ideas developed by the external community into CFSv3

- **Increase collaborations between NCEP and the external community** (other NOAA labs/centers, other agencies, and universities and the private sectors)
  - Build connections and partnerships
  - Validate user requirements

NOAA Commitment for CFS Applications and Future Development

- **NOAA Grants Programs**
  - Create funding opportunities to bring NOAA labs/centers and the external community on key model challenges

- **NCEP FTE Support**
  - Internal development
    - Dedicated Climate Modeling Team from EMC and CPC
  - NCEP- External Joint Projects
    - CTB grants projects
  - User Support
    - User-friendly model codes and scripts; documentation

- **NOAA Computer Resources for Climate Studies**
  - GAEA – Oak Ridge, TN
  - ZEUS – Fairmont, WV
  - Operational WCOSS

NOAA Center for Weather and Climate Prediction

- Four-story, 268,762 square foot building in Riverdale, MD will house 800+ Federal employees, and contractors
  - 5 NCEP Centers (NCO, EMC, HPC, OPC, CPC)
  - NESDIS Center for Satellite Applications and Research (STAR)
  - NESDIS Satellite Analysis Branch (SAB)
  - OAR Air Resources Laboratory

- Includes 40 spaces for visiting scientists
- Includes 465 seat auditorium/ conference center, library, deli, fitness center and health unit

Move Schedule

T minus 13 weeks and counting!

- February 2, 2012 – data center setup began!
- April 7, 2012 – Building operations transferred to new owner
  - Furniture being installed and wired
- July 30, 2012 – begin phased move-in
  - Front offices
  - Non-operational groups
- August 2012 – dual operations
- September 2012 – complete move
- September/October 2012 – ribbon-cutting ceremony

February 2, 2012

Data Center at NCWCP

Summary

- **CFS is the operational climate forecast system for the nation for intra-seasonal to interannual forecasts**
- **Actively engaged in IMME and NMME**
- **NCEP is committed to take the CFSv3 to the next level**

New Opportunities at NCEP

- **New Computer**
  - IBM IDataPlex System, 149 TF, 7168 cores
- **NOAA Center for Weather and Climate Prediction**
  - Space for 40 Visiting scientists
- **CFSv3 development in coordination with the broader community**
  - CFSv3 Planning meeting in August, 2011
  - CFSv2 Evaluation Workshop today
    - White Paper on CFSv3 priorities
  - Work all of this through the CTB